SECTION 16470

PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power Panelboards.

B. Lighting and Appliance Panelboards.

1.2 QUALITY ASSURANCE

A. Provide products specified in this Section that are UL listed and labeled.

B Components and installation shall comply with ANSI/NFPA 70—*National Electrical Code*.

C. Comply with NEMA PB1—*Panelboards*, and NEMA AB1 — *Circuit Breakers*

D. Comply with UL 67—*Panelboards*, UL 50—*Cabinets and Boxes*, and UL *489—Circuit Breakers*.

E. Comply with Federal Specification W-P-115C Type I, Class 1 — *Circuit Breaker Panelboards*.

F. Provide products suitable for operation at 7500 ft. altitude.

1.3 SUBMITTALS

Provide the following submittals according to the requirements of Sections 01300 and 01700:

A. Catalog data for each type panelboard, accessory item, and component specified.

B. Shop drawings from manufacturers of panelboards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

1. Enclosure type with details for types other than NEMA Type 1.

2. Bus configuration and current ratings.

3. Short-circuit current rating of panelboard.

4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

C. Wiring diagrams detailing schematic diagram including control wiring, and differentiating between manufacturer-installed and field-installed wiring.

D. Maintenance data for panelboard components, for inclusion in Operating and Maintenance Manual. Include instructions for testing circuit breakers.

E. Panel circuit directory cards for installation in panelboards. Submit final versions after load balancing.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inspect panelboards on delivery and report concealed damage to the carrier within their required time.

B. Handle panelboards carefully to avoid damage to panelboard internal components, enclosure, and finish.

C. Store panelboards in a clean, dry environment. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

1.5 EXTRA MATERIALS

A. Furnish six spare keys of each type for panelboard cabinet locks.

B. Provide one spray can of touch-up paint that matches panelboard finish.

PART 2 PRODUCTS

2.1 PANELBOARDS, GENERAL REQUIREMENTS

A. Provide panelboard cabinets for flush or surface mounted as indicted on the Drawings.

1. Furnish NEMA Type 1 enclosures, except where the Drawings indicate the following enclosure requirements.

a. NEMA 3R: Raintight.

b. NEMA 3S: Raintight and dust tight.

c. NEMA 4X: Corrosion-resistant fiberglass enclosure, watertight, dust tight, and resistant to oil and coolant seepage.

d. NEMA 12: Dust tight, dripproof, and resistant to oil and coolant seepage.

2. Cabinets shall be galvanized steel constructed according to UL 50 requirements. Zinc coated galvanealed steel is not acceptable.

3. NEMA 1 boxes shall have removable end walls. NEMA 3, 3S, 4X and 12 boxes shall have end walls welded and sealed.

B. Provide trim fronts that meet the strength and rigidity requirements of UL 50.

1. Fronts for surface-mounted panels shall be same dimensions as box.

2. Fronts for flush panels shall overlap boxes at least 1 inch.

3. Fronts shall have ANSI 49 medium gray enamel electro-deposited over cleaned, phosphatized steel.

4. For NEMA 1 panelboards, provide fronts with hinged trim construction having a piano hinge down one side. The front shall containing a smaller lockable door, which when open, shall provide access to all device handles and rating labels. The hinged front, when open, shall provide access to all conductors and wiring terminals. The panelboard door shall open by a single lockable latch; the entire hinged front trim shall open by removing screws.

5. Provide a metal panelboard directory frame mounted inside the panelboard door.

6. Provide cylindrical tumbler type locks. Provide sliding vault locks with 3-point latching for enclosures more than 48 inches high. Key all lock assemblies alike. Provide two (2) keys with each lock plus spares as required in the Extra Materials paragraph above.

C. Panelboard phase and neutral bus shall be copper. Panelboard bus current ratings shall be determined by heat-rise tests conducted according to UL 67. Panelboards used on 480V and 480Y/277V systems shall have bus insulators and separations rated for 600V.

D. Provide compression type lugs for 100 amperes and larger main, neutral and branch circuit lugs; smaller lugs shall be mechanical type.

E. Provide copper or aluminum equipment ground bus that is adequate for feeder and branch-circuit equipment ground conductors. Bond ground bus to box.

F. Panelboards having a main circuit breaker shall be UL listed for use as service entrance equipment.

G. Equip panelboards with mounting brackets, bus connections, and necessary appurtenances, for the future installation of circuit breakers in the “spaces” scheduled on the Drawings.

H. Provide panelboards having UL listed short circuit current ratings not less than the available fault current indicated on the Drawings. With the exception of panelboard with a current-limiting main circuit breaker, do not use “series ratings” for circuit breaker interrupting capacities. The short circuit rating for a panelboard without a current-limiting main circuit breaker shall not exceed the lowest interrupting capacity rating of any circuit breaker installed in the panelboard.

I. Provide thermal-magnetic circuit breakers that meet the requirements of UL 489 — *Molded Case Circuit Breakers*, NEMA AB 1 — *Molded Case Circuit Breakers and Molded Case Switches,* and Federal Specification W-C 375B/GEN — *Molded Case Circuit Breakers*.

1. Provide circuit breakers of the type, rating, and features as indicated on the Drawings.

2. Provide 600V rated two-pole and three-pole circuit breakers for 480V or 480Y/277V systems.

3. Provide circuit breakers with the following minimum UL listed interrupting capacities:

   a. 208Y/120V and 120/240V applications: 10,000 amperes, RMS symmetrical

   b. 480V and 480Y/277V applications: 14,000 amperes, RMS symmetrical

4. Do not use tandem circuit breakers.

5. Provide multipole breakers with a common trip.

6. Provide bolt-on type circuit breakers or circuit breakers that connect to the panel bus through positive gripping connector jaws and are secured by an independent mechanical locking device.

J. Provide circuit breaker padlocking provisions for panelboard main circuit breaker and for all two-pole and three-pole circuit breakers.

K. Provide the following special features for panelboards as indicated on the Drawings.

1. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from the box.

2. Split Bus: Vertical buses of indicated panels divided into two vertical sections with connections as indicated.

3. Skirt for Surface-Mounted Panels: Same gage and finish as panel front with flanges for attachment to panel, wall, and the floor.

4. Contactors in Mains: Mechanically held, with current rating, poles, and connections as indicated on the Drawings.

5. Control Power Source: Control power transformer of capacity indicated, for contactor shunt trip or other devices. Mount in cabinet of panel indicated. Protect primary with current-limiting fuses. Provide fused protection of control circuits.

6. Extra Gutter Space: Dimensions and arrangement as indicated.

7. Gutter Barrier: Arranged to isolate section of gutter as indicated.

8. Auxiliary Gutter: Conform to UL 870, "Wireways, Auxiliary Gutters and Associated Fittings."

9. Column-Type Panelboard Configuration: Narrow cabinet extended as wireway to overhead junction box equipped with ground and neutral terminal buses.

10. Neutral bus rated 200% of the phase bus for high harmonic applications.

11. Subfeed circuit breaker or lug provision as indicated.

12. Feed-Through Lugs: Sized to accommodate feeders indicated.

13. Surge Arresters conforming to IEEE C62.11, "Standards for Metal-Oxide Surge Arresters for AC Power Circuits," or IEEE C62.1, "Surge Arresters for Alternating Current Power Circuits." Coordinate impulse sparkover voltage with system circuit voltage and provide factory mounting with UL-recognized mounting device.

2.2 POWER PANELBOARDS

A. Main bus rating for the power panelboards described in this Section shall not exceed 800 amperes. Refer to Section 16425, DISTRIBUTION SWITCHGEAR for distribution equipment with greater than 800 ampere bus.

B. Power panelboard enclosure dimensions shall not exceed 32 inches in width and 18 inches in depth.

C. Manufacturers:

1. General Electric “Spectra Series”

2. Siemens “Sentron S4 and S5 Series”

3. Square D “I-LINE”

4. Westinghouse ”Pow-R-Line 4"

2.5 LIGHTING AND APPLIANCE PANELBOARDS

A. Lighting and appliance branch circuit panelboard enclosures shall be not less than 20 inches nor more than 26 inches in width.

B. Manufacturers:

1. General Electric “Spectra” (480Y/277V) and “AQ” (208Y/120V or 120/240V).

2. Siemens “Sentron S3" (480Y/277V) and “Sentron S1" (208Y/120V or 120/240V).

3. Square D “I-LINE” (480Y/277V) and “NQOD” (208Y/120V or 120/240V).

4. Westinghouse ”Pow-R-Line 3" (480Y/277V) and “Pow-R-Line 1” (208Y/120V or 120/240V).

2.3 PANELBOARDS FOR INSTRUMENT AND COMPUTER LOADS

A. Provide panelboards for 208Y/120V or 120/240V instrument and computer loads.

B. Enclosures shall be not less than 20 inches nor more than 26 inches in width.

C. Provide a 200% rated neutral bus.

D. Provide an isolated ground bus in addition to the equipment ground bus. Size isolated ground bus to accept feeder and branch-circuit isolated ground conductors that are the same size as the corresponding circuit phase conductors.

E. Manufacturers:

1. General Electric “AQ” (208Y/120V or 120/240V)

2. Siemens “Sentron S1" (208Y/120V or 120/240V)

3. Square D “NQOD” (208Y/120V or 120/240V)

4. Westinghouse “Pow-R-Line 1” (208Y/120V or 120/240V)

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Install panelboards following manufacturer’s written instructions, NEMA PB 1.1 — *General Instructions for Proper Installation and Maintenance of Panelboards Rated 600 Volts or Less*, and ANSI/NFPA 70.

B. Install panelboards with top of panelboard trim 6'-2" (maximum) above finished floors.

C. Mount panelboards plumb and rigid without distortion of the box. Mount flush panels uniformly flush with wall surfaces.

D. Install filler plates in unused spaces in panelboards.

E. At flush panelboards stub four 1-inch empty conduits from panels into accessible ceiling space or space designated to be ceiling space in future. Stub four 1-inch empty conduits into raised floor space or below slabs other than slabs on grade.

F. Install an auxiliary gutter with permanently installed terminal blocks where a panel is tapped to a riser at an intermediate location.

G. Train conductors in panelboard gutters neatly in groups; bundle and wrap with cable ties after completion of load balancing.

H. Tighten electrical connectors and terminals, including grounding connections, according to the manufacturer’s published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

### 3.2 IDENTIFICATION

A. Provide a typed circuit directory for each branch circuit panelboard. Revise directories to reflect circuiting changes required to balance phase loads.

B. Install electrical identification on panelboards and conductors according to Section 16195 ELECTRICAL IDENTIFICATION.

C. Mark floor in front of panelboards to show ANSI/NFPA 70 required working clearances according to Section 16195 ELECTRICAL IDENTIFICATION.

### 3.3 CLEANING

Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

### 3.4 LOAD BALANCING

A. After Substantial Completion, but not more than two months after Final Acceptance, conduct load-balancing measurements and circuit changes as follows:

1. Do measurements during period of normal working loads as advised by the User.

2. Do load-balancing circuit changes outside the normal occupancy/working schedule of the facility. Arrange with User to avoid disrupting critical 24-hour services such as FAX machines and on-line data processing, computing, transmitting, and receiving equipment.

3. Difference between any phase current and the average of the phase currents exceeding 20 percent at any one panelboard is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

4. Recheck loads after circuit changes during a normal load period. Record all load readings before and after changes and submit test records.

3.5 FIELD QUALITY CONTROL

A. Inspect installed panelboards for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

B. Upon completing installation of the system, perform the following tests:

1. Make insulation resistance tests of panelboard buses, components, and connecting supply, feeder, and control circuits.

2. Make continuity tests of circuits.

C. Refer to Section [16950] [16951] ELECTRICAL ACCEPTANCE TESTING for additional inspection, testing and calibration requirements.

END OF SECTION